

INDOOR AIR QUALITY ASSESSMENT

**Massachusetts Department of Revenue
Fall River Office, Center Place
218 South Main Street
Fall River, Massachusetts**



Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health
Emergency Response/Indoor Air Quality Program
January 2007

Background/Introduction

At the request of Donald Trudell of the Massachusetts Department of Revenue (DOR), an indoor air quality assessment was conducted at the Fall River DOR office, 218 South Main Street. This assessment was conducted by the Massachusetts Department of Public Health (MDPH), Center for Environmental Health (CEH). The request was prompted by concerns regarding odors resulting from materials used during demolition of the South Main Place Mall (SMPM), a property adjacent to the DOR office.

The SMPM was constructed in the 1970s (Picture 1) and is scheduled for demolition as part of the Fall River District Court construction project. Asbestos tile abatement at the SMPM was reportedly completed on Wednesday, January 3, 2007. According to Mr. Trudell, the DOR office was closed on Friday January 5, 2007 and Monday, January 8, 2007 due to an unidentified chemical odor that was attributed to the SMPM demolition work.

On January 8, 2007 a visit was made to this building by Michael Feeney, Director of Emergency Response/Indoor Air Quality (ER/IAQ Program. As previously indicated, the DOR offices were unoccupied on this date. Mr. Feeney returned to the Fall River DOR office on January 9, 2007 to conduct further air monitoring while the offices were occupied. DOR staff reported that the odor was strongest on the first floor at the front of the building, along the wall shared with the SMPM.

Methods

Air tests for carbon dioxide, carbon monoxide, temperature and relative humidity were conducted with the TSI, Q-TRAK™ IAQ Monitor, Model 8551. Screening for total volatile

organic compounds (TVOCs) was conducted with a HNu, Model 102 Snap-on Photo Ionization Detector (PID).

Results

The DOR offices have a population of approximately 10 to 20 employees. TVOC measurements taken at the offices on January 8 2007 appear in Table 1. General indoor air quality tests and screening for TVOCs were conducted on the January 9, 2007 assessment; these results appear in Table 2.

Discussion

Ventilation

The carbon dioxide levels measured in all DOR offices were below 800 ppm (parts per million), which is indicative of adequate ventilation. Ventilation in this building is provided by a heating, ventilation and air conditioning (HVAC) system. Ducted air diffusers distribute fresh air to the office space. Air diffusers are designed to create airflow by directing air to move along the ceiling and down walls, which allows for fresh air to mix and circulate. Mechanical exhaust ventilation is provided by ceiling-mounted vents.

To maximize air exchange, the MDPH recommends that both supply and exhaust ventilation operate continuously during periods of occupancy. In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. It is recommended that HVAC systems be re-balanced every five years to ensure

adequate air systems function (SMACNA, 1994). The date of the last balancing was unknown at the time of the assessment.

The Massachusetts Building Code requires that each area have a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or openable windows (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The MDPH uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please see [Appendix A](#).

Temperature was measured within a range of 69° F to 72° F, which was close to the MDPH recommended range for comfort. The MDPH recommends that indoor air temperatures

be maintained in a range between 70° F to 78° F in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

Relative humidity measured on the third floor ranged from 24 to 39 percent, slightly below the MDPH recommended comfort range of 40 to 60 percent. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

TVOCs

CEH staff arrived at the DOR office at approximately 1:00 PM on January 8, 2007. A background level of 0.2 ppm TVOCs was measured outside the building prior to entering the DOR office. At this time, vehicle traffic was moderate and construction activity was light. TVOC levels measured on the first floor of the DOR office ranged from 0.2 ppm in the front lobby to 0.7 ppm detected at the electrical socket and in seams of the plastic coving along the DOR wall shared with the SMPM.

CEH staff examined the SMPM area where the tiles were removed on January 3, 2007. The area is located in an unventilated hallway that runs the length of the wall shared with the DOR office. This area has no means for either mechanical or natural ventilation (Picture 2). TVOC levels measured in this hallway on January 8, 2007 were 4.2 ppm. The product used in the tile removal process is reportedly Chemsafe 100 (Aramco, 2006; [Appendix B](#)), a product containing a hydrocarbon mixture (CAS. No. 64742-88-7, Stoddard solvent IIc) and ethylene glycol monobutyl ether (CAS No. 111-76-2), both of which are volatile organic compounds. The OSHA permissible exposure limit (PEL) for a Stoddard solvent (roughly equivalent to

Stoddard solvent IIc) is 500 ppm and ethylene glycol monobutyl ether is 50 ppm. Workers may be exposed to this level, based on a time-weighted average for 40 hours/week (OSHA, 2006). At no time during the air sampling on January 8-9, 2007 did levels exceed OSHA PELs. Each chemical is also heavier than air, and removal of chemical vapors from the hallway would require mechanical ventilation.

During close examination of the wall between DOR and SMPM, CEH staff discovered that a space approximately 2 feet wide separates the two buildings (Picture 3). Air sampling within the wall space on January 8, 2007, produced a TVOC measurement of 1.5 ppm, indicating that the TVOCs were migrating from hallway where the tile was removed into the wall cavity. Examination of the brick wall on the DOR side of the wall cavity revealed window frames sealed with brick and mortar (Picture 4). Breaches were observed around these window frames. These breaches, the presence of chemical odors in the DOR offices (as reported by DOR staff and Fall River Health Department officials on Friday, January 5, 2007), and measurable levels of VOCs indicate that a pathway for airflow exists in the wall cavity space between the DOR and SMPM.

A cold draft was detected from a crack in the gypsum wallboard (GW) in the front corner of the DOR first floor office (Picture 5). CEH staff temporarily sealed the crack with duct tape (Picture 6). The cold air infiltrating the DOR office provides additional evidence of a pathway between the two buildings. Cold outdoor air appears to be entering the wall cavity space, which in turn pressurizes this space to force TVOCs into areas occupied by DOR through openings in the GW, such as electrical outlets and seams between the wall coving and carpet.

Based on these observations, CEH staff recommended depressurizing the shared wall cavity with a portable fan (Picture 7). Holes cut in the GW on the SMPM side of the wall were

sealed with polyethylene plastic and duct tape (Picture 8) to maximize the draw of air from the wall cavity.

During the January 9, 2007 visit, workers reported a lingering odor in the DOR offices on the first floor. Screening for TVOCs on the first floor ranged from 0.2 ppm in the front lobby to 0.5 ppm detected at the electrical socket and in seams of the plastic coving along the DOR wall shared with the SMPM. These levels would be expected to drop towards background level as the exhaust fan continues to draw air from the shared wall cavity.

Conclusions/Recommendations

It is important to note that TVOC screening with a PID does not identify specific contaminants; it is used as a screening tool only. While none of the OSHA PELs for hazardous ingredients listed on the MSDS were exceeded during these visits, odors in the building were reportedly noticeable enough to cause a variety of acute symptoms in DOR staff. In consideration of these conditions, the following recommendations were made to minimize occupant exposure to construction materials during renovations:

1. Use exhaust fans to draw air from the shared wall cavity. To the knowledge of CEH staff, the SMPM contractor shift begins at 6:30AM. It recommended that this fan be activated at the start of the SMPM contractor shift and operate until the end of the DOR work day.
2. Mop the floor of the SMPM hallway where the tile was removed to remove excess residue left from the Chemsafe 100 product.
3. Identify the source of cold air pressurizing the DOR wall cavity. The two likely sources are the expansion joint between the two buildings (Picture 9) and/or a hole through the SMPM exterior wall (Picture 10).

4. Seal electrical sockets, cracks in GW, seams in wall coving, the seam between the wall coving and carpet and other means of egress in the affected area, which can serve as pathways for materials to enter occupied spaces from the wall cavity.
5. Use floor fans to pressure the offices along the shared wall with the SMPM.
6. As a safety measure, install a carbon monoxide (CO) detector in the SMPM near the front of the building to detect any build up of products of combustion from gasoline, diesel, propane, acetylene or other flammable materials used for fuel during demolition activities. If the CO alarm activates, cease activities and ventilate the area with exhaust fans.

References

- AramSCO. 2006. Material Safety Data Sheet. Chemsafe 100. AramSCO, Thorofare, NY.
<https://secure.aramSCO.com/msds/00003058.pdf>
- BOCA. 1993. The BOCA National Mechanical Code/1993. 8th ed. Building Officials and Code Administrators International, Inc., Country Club Hill, IL. Section M-308.1.1.
- OSHA. 1997. Limits for Air Contaminants. Occupational Safety and Health Administration. Code of Federal Regulations. 29 C.F.R. 1910.1000 Table Z-1-A.
- SBBRS. 1997. Mechanical Ventilation. State Board of Building Regulations and Standards. Code of Massachusetts Regulations. 780 CMR 1209.0
- SMACNA. 1994. HVAC Systems Commissioning Manual. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

Picture 1



The South Main Place Mall (SMPM)

Picture 2



SMPM Hallway Where Tiles Were Removed

Picture 3



Wall Cavity Between DOR And SMPM

Picture 4



Bricked filled Window Of DOR Building

Picture5



Crack In GW Of DOR Office, First Floor

Picture 6



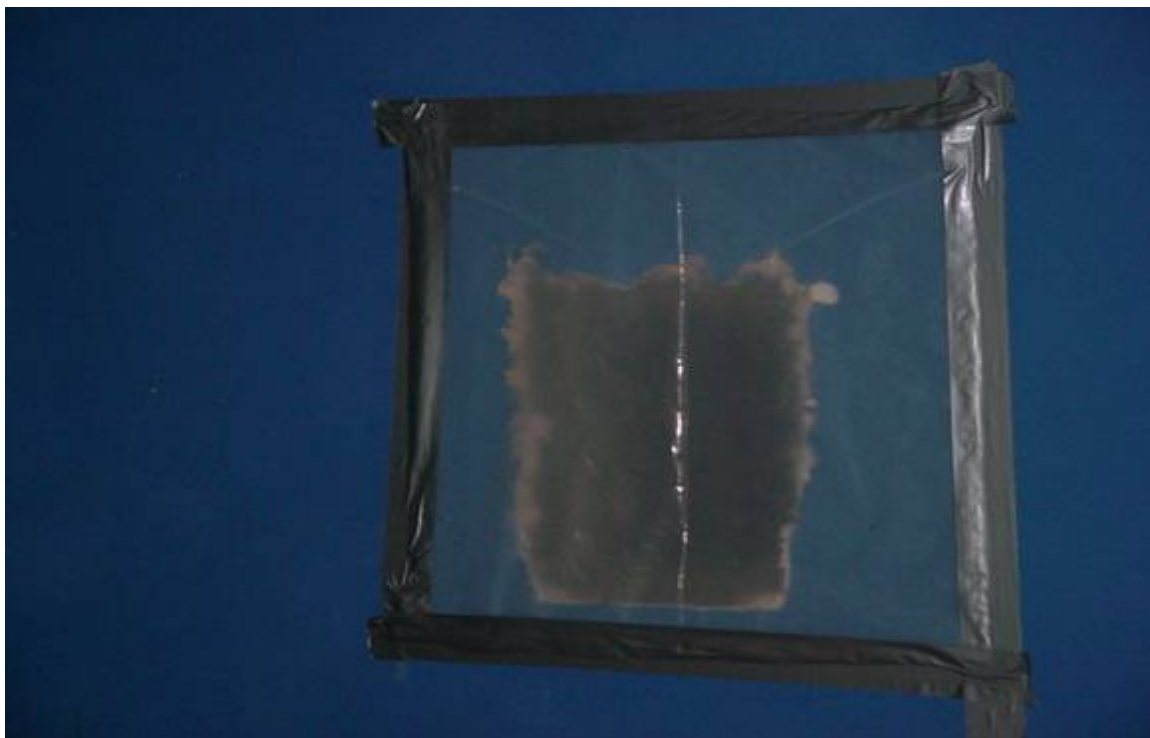
Crack In Picture 4 Sealed With Duct Tape

Picture 7



Portable Fan Used To Depressurize Shared Cavity

Picture 8



Hole In SMPM GW Sealed With Polyethylene Plastic And Duct Tape To Maximize Wall Space Depressurization

Picture 9



Expansion Joint Between SMPM And DOR Building

Picture 10



Wall Penetration For Utility In SMPM Wall Near DOR Building

TABLE 1
Indoor Air Test Results
Department of Revenue, Fall River Office 218 South Main Street, Fall River, MA
January 8, 2007

Locations	Total Volatile Organic Compounds (TVOCs) *ppm	Remarks
Outside (Background)	0.2	
3 rd floor DOR office	0.2	
2 nd floor private office, middle of room	0.2	
2 nd floor private office, at electrical socket	0.5	
1 st floor DOR office, middle of room	0.2	
1 st floor DOR office, at seam of GW wall coving	0.5	
SMPM inside wall cavity, first floor	1.5	Holes opened in GW to inspect wall cavity
SMPM hallway where Chemsafe 100 was used to remove floor tile	4.2	

* ppm = parts per million parts of air

TABLE 2
Indoor Air Test Results
Department of Revenue, Fall River Office 218 South Main Street, Fall River, MA
January 9, 2007

Remarks	Carbon Dioxide (*ppm)	TVOC	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
							Supply	Exhaust	
Outside (Background)	377	0.2	36	52					
309 meeting room	484	0.2	69	39	0	N	Y	N	Door open
308	442	0.2	69	34	0	N	Y	N	Door open
310	455	0.2	69	31	2	N	Y	N	Water damaged carpet Door open
3 rd floor northwest corner	502	0.2	71	28	1	N	Y	N	Water cooler on carpet Water damaged carpet plants
Sylvia office	480	0.2	72	26	1	N	Y	N	Door open
Cubicles west	511	0.2	72	27	4	N	Y	N	
Cubicles southwest	512	0.2	72	24	2	N	Y	Y	
Ganet office	492	0.2	72	24	0	N	Y	N	Door open
Byar Office	555	0.2	72	24	1	N	Y	N	Door open

* ppm = parts per million parts of air

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred 600 - 800 ppm = acceptable > 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2
Indoor Air Test Results
Department of Revenue, Fall River Office 218 South Main Street, Fall River, MA
January 9, 2007

Remarks	Carbon Dioxide (*ppm)	TVOC	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
							Supply	Exhaust	
Cubicle south	634	0.2	72	28	5	N	Y	N	
Cubicle southeast	754	0.2	72	28	6	N	Y	Y	
Breakroom	544	0.2	72	27	0	N	Y	Y	
307	508	0.2	72	27	0	N	Y	Y	
1 st floor lobby	450	0.2	71	25	0	N	Y	Y	
101 front desk	556	0.2	69	27	1	N	Y	Y	
101 behind desk center of room	442	0.2	70	26	2	N	Y	Y	
101 behind desk at seam between wall coving		0.7							
102 cubicles center of room	430	0.2	71	25	1	N	Y	Y	
102 cubicles center of room at seam									

* ppm = parts per million parts of air

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							Supply	Exhaust	
between wall coving									

* ppm = parts per million parts of air

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
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Temperature - 70 - 78 °F
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Appendix B
Material Safety Data Sheet for Chemsafe 100

01/08/2007 11:04 FAX 8178263589
V1/08/2007 09:11 FAX

MA DOR

002/004
003/005

MATERIAL SAFETY DATA SHEET

TRADE NAME: CHEMSAFE 100

COMPLETS WITH USDL SAFETY AND HEALTH REGULATIONS, (29 CFR 1910.1200)

PAGE 1 OF 3

I CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

DATE: 3/15/08
TRADE NAME: CHEMSAFE 100
GENERAL OR GENERIC ID: HYDROCARBON MIXTURE
MANUFACTURED FOR: ARAMSCO
1480 GRANDVIEW AVENUE
THOROFARE, NJ 08086
(800) 787-8933

24 HOURS TRANSPORTATION EMERGENCY NUMBER: CHEM-TREC (800) 424-9300

HMIS RATING: HEALTH (1) FIRE (2) REACTIVITY (0)
4 = EXTREME, 3 = HIGH, 2 = MODERATE, 1 = SLIGHT, 0 = INSIGNIFICANT * = CHRONIC HAZARD

II COMPOSITION INFORMATION ON INGREDIENTS

INGREDIENTS	CAS#	ACGIH TLV	OSHA PEL	% OPTIONAL
HYDROCARBON MIXTURE	84742-88-7	NE	NE	
	(HOWEVER ARAMSCO RECOMMENDED PEL IS 525MG/M3 FOR 8-HOUR TWA) (EXPOSURE LIMITS FOR PETROLEUM DISTILLATE - STODDARD SOLVENT)			
ETHYLENE GLYCOL MONOBUTYL ETHER	111-76-2	25PPM	25PPM	
NE = NON ESTABLISHED AT THIS TIME				

III PHYSICAL / CHEMICAL CHARACTERISTICS

BOILING RANGE: > 300F	SPECIFIC GRAVITY (WATER = 1): .8077
VAPOR PRESSURE (mm hg): < 1	MELTING POINT: N/A
VAPOR DENSITY, (AIR = 1): > 1	EVAPORATION RATE (BUTYLACETATE = 1): < 1
SOLUBILITY IN WATER: EMULSIFIES	PERCENT VOLATILE: 90 - 98
APPEARANCE AND ODOR: BLUE LIQUID, WITH MILD ODOR	

IV FIRE AND EXPLOSION DATA

FLASH POINT, (METHOD USED): 142F - 150F FLAMMABLE LIMITS: ND
EXTINGUISHING MEDIA: CO₂; WATER FOG; DRY CHEMICAL; CHEMICAL FOAM
FIRE FIGHTING PROCEDURES: WEAR SELF CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE
AND TOTAL PROTECTIVE CLOTHING.
UNUSUAL FIRE AND EXPLOSION HAZARDS: VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL ALONG
THE GROUND OR BE MOVED BY VENTILATION AND IGNITED
BY HEAT, PILOT LIGHTS, FLAMES AND OTHER IGNITION
SOURCES.

V REACTIVITY DATA

STABILITY DATA: STABLE
INCOMPATIBILITY (MATERIALS TO AVOID): STRONG ACIDS / STRONG OXIDIZERS
HAZARDOUS DECOMPOSITION OR BYPRODUCTS: THERMAL DECOMPOSITION MAY YIELD CO; CO₂; AND
VARIOUS HYDROCARBONS.
HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

Appendix B
Material Safety Data Sheet for Chemsafe 100

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003/004
004/005

MATERIAL SAFETY DATA SHEET

TRADE NAME: CHEMSAFE 100

VI HEALTH HAZARD DATA

PAGE 2 OF 3

SIGNS AND SYMPTOMS OF EXPOSURE:

INHALATION: PROLONGED EXPOSURE MAY RESULT IN IRRITATION OF RESPIRATORY TRACT.
SKIN: PROLONGED EXPOSURE MAY CAUSE MILD SKIN IRRITATION. SYMPTOMS MAY INCLUDE REDNESS, DRYING AND CRACKING.
EYES: EXPOSURE MAY CAUSE IRRITATION. SYMPTOMS MAY INCLUDE STINGING, TEARING, AND REDNESS.
INGESTION: MAY CAUSE DIARRHEA, GASTRIC PAIN, AND VOMITING. MATERIAL CAN ENTER THE LUNGS DURING SWALLOWING OR VOMITING AND CAUSE LUNG INFLAMMATION AND/OR DAMAGE.

HEALTH HAZARDS (ACUTE AND CHRONIC): HEADACHE, DIZZINESS, AND NAUSEA.

CARCINOGENICITY: NTP: NO IARC MONOGRAPHS: NO OSHA REGULATED: NO
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: NONE KNOWN

EMERGENCY FIRST AID PROCEDURES

INHALATION: MOVE INDIVIDUAL AWAY FROM EXPOSURE AND INTO FRESH AIR. PROVIDE OXYGEN OR ARTIFICIAL RESPIRATION IF NEEDED. SEEK MEDICAL ATTENTION.
INGESTION: DO NOT INDUCE VOMITING. THIS MATERIAL IS AN ASPIRATION HAZARD. IF SPONTANEOUS VOMITING OCCURS, KEEP HEAD BELOW HIPS TO PREVENT ASPIRATION OF LIQUID INTO THE LUNG. SEEK MEDICAL ATTENTION.
EYE CONTACT: FLUSH EYES WITH WATER HOLDING EYELIDS APART FOR 15 MINUTES. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION.
SKIN CONTACT: REMOVE CONTAMINATED CLOTHING. FLUSH AREA WITH WATER FOR 15 MINUTES. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION.

VII PRECAUTIONS FOR DISPOSAL, SAFE HANDLING, AND USE

SPILLS: **SMALL SPILLS:** ABSORB w/VERMICULITE OR OTHER ABSORBENT.
LARGE SPILLS: ELIMINATE ALL IGNITION SOURCES. STOP SPILL AT SOURCE. PREVENT FROM ENTERING DRAINS, SEWERS, AND STREAMS. PUMP INTO APPROVED CONTAINERS. ABSORB UNRECOVERABLE PRODUCT AND DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REGULATIONS.
WASTE DISPOSAL METHOD: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REGULATIONS.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: KEEP CONTAINER CLOSED WHEN NOT IN USE. PROTECT CONTAINERS FROM ABUSE AND EXTREME TEMPERATURES.
OTHER PRECAUTIONS: EMPTIED CONTAINERS CONTAIN PRODUCT RESIDUES AND ALL PRECAUTIONS WITHIN THIS MSDS STILL APPLY AND SHOULD BE FOLLOWED.

VIII CONTROL MEASURES

RESPIRATORY PROTECTION: IF WORKPLACE EXPOSURE LIMITS OF PRODUCT OR ANY COMPONENT IS EXCEEDED, A NIOSH/MSHA APPROVED AIR SUPPLIED RESPIRATOR IS ADVISED IN ABSENCE OF PROPER ENVIRONMENTAL CONTROL. OSHA REGULATIONS ALSO PERMIT OTHER NIOSH/MSHA RESPIRATORS (NEGATIVE PRESSURE TYPE) UNDER SPECIFIED CONDITIONS.
VENTILATION: MECHANICAL VENTILATION TO MAINTAIN EXPOSURE BELOW TLV'S
PROTECTIVE GLOVES: NEOPRENE OR RUBBER
EYE PROTECTION: CHEMICAL GOGGLES WITH SIDE SHIELDS
WORK/HYGIENIC PRACTICES: EXHIBIT NORMAL SAFE WORKPLACE HABITS.

Appendix B
Material Safety Data Sheet for Chemsafe 100

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MA DOR

004/004
005/005

MATERIAL SAFETY DATA SHEET

TRADE NAME: CHEMSAFE 100

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IX TRANSPORTATION

This product is **NOT REGULATED** if packaged under 119 gallons per container by D.O.T.

DOT SHIPPING NAME: COMBUSTIBLE LIQUID, N.O.S., (CONTAINS HYDROCARBON MIXTURE)

PLACARDING: PLACARDING EXEMPTION 173 . 150 (F)

HAZARD CLASS: 3

IDENTIFICATION NO: NA1893

PACKING GROUP: III

RQ (REPORTABLE QUANTITY): N/A

X REGULATORY INFORMATION

SARA TITLE III: 313: Glycol Ethers Mex % 12%
(RIGHT-TO-KNOW INVENTORY)

SPECIAL PRECAUTIONS / OTHER COMMENTS

The information contained herein is believed to be accurate but is not warranted to be so. Users are advised to confirm in advance of need, that information is current, applicable and suited to the circumstances of use. Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Furthermore, vendor assumes no responsibility for injury caused by abnormal use of this material even if reasonable safety procedures are followed.